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REPORT OF INVESTIGATION

COOPERATIVE of MANZANEROS, S.A.

CHICHI QUICHE

GUATEMALA, C.A.

MARCH 5, 1983

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REPORT SUMMARY

The name of the newly formed cooperative is Chichicastenango Fruit Growers, SA. The cooperative members are fruit growers in the Chichicastenango area of western Guatemala. The purpose of the cooperative association is to perform grading, packing, storage and marketing of apples.

The Association has received its corporate charter. It has 37 member producers. It has elected the following officers: Diego Xiloj Saqic, President; Arturo Mendez, Vice President; Arnulfo Rodas, Secretary. Eduardo Juarez is President of the Commission of Agriculture. Members of the Association produce an estimated tonage of 6000 cwt. of apples. There is also a small production of other fruits, primarily peaches. Production is expected to increase from some of the younger plantings. It is expected there may be some additional fruit from prospective members.

Principle varieties are Red Delicious (50%), Winter Banana (25%), Jonathon (15%), Wealthy (10%). Orchards visited were in a good state of growth and reflected acceptable cultural practices consistent with local practices. There is evidence that apple scab is the principle disease. Control measures are costly and only partially successful. The winter season temperatures are not low enough or sufficiently prolonged to bring about a full dormancy of the fruit trees. This results in long blossom periods, low fruit bud differentiation and a low state of vigor during the early growing season. This is additionally complicated by generally cloudy weather during the growing season which reduces sunlight.

Under existing practices the fruit is separated into three levels of quality in the orchard. It is sold to truckers who in turn sell it to wholesalers in the terminal markets. All fruit is sold during the harvest season without benefit of cold storage facilities. Often the volume of fruit seeking a market depresses the price structure, especially on lower quality fruit.

The cooperative Association proposes to offer some improvements and alternatives to the present practices by the following services:

1. Grade and pack all fruit at a central location.
2. Establish uniform high quality grade standards.
3. Provide cold storage for best quality fruit to be sold for late market.
4. Establish direct market relations to wholesalers.
5. Establish an accounting system that will reflect full market value to the producer less costs of operation and materials.
6. Provide production supplies and production credit to producer members.
7. Advice to growers concerning production practices will be provided by existing government horticulturists.

Facilities to be provided by the Association will be as follows:

1. A building which will house the grading and packing operation and cold storage rooms. The building will also provide space for supplies, refrigeration equipment and an office.

2. Land of such a size that will accommodate the buildings, provide space for unloading and loading fruit and be suitable for future expansion. Such location must be provided with a proper electrical and water supply.
3. Miscellaneous facilities including picking containers, hand trucks, tools, etc.

Financing of the Association will be provided as follows:

1. Member contribution or investment in the sum of $200 per member for the purchase of one share of common voting stock.
2. Member contribution in such additional amounts necessary to provide the land and civil improvements.
3. Loans from the BANBESA sufficient to construct the buildings, install refrigeration and packing equipment, prepare loading and unloading areas, provide operating and loan capital.
4. Surplus margins from service charges and capital retains accumulated each year will gradually increase grower capital equity and will be used to service the debt load.

The Association will prepare the following:

1. Time table of development of facilities.
2. An operating budget and income projection based upon estimated volume of business.
3. A schedule of service charges and capital retains.
4. Procedures of operations outlining job descriptions

and lines of authority and responsibility.

5. Schedule of operating policies.

6. Prepare a corporate organizational chart.

The association of farm people into a commercial business enterprise is a new and often strange experience. This should be recognized in this instance and a special effort should be made to make this experience for these people as easy as possible. It is not enough to only provide capital funds and expect that the Association can solve all the other problems attendant to the establishment of a major business. The Association will need careful guidance and support for a number of years. The lending agency cannot afford to risk the loss of the financial inventment nor the damage it will cause to all parties concerned, social economic and political.

Some of the more important areas of concern will be as follows:

1. Technical competence to operate and service cold storage facilities.
2. Experienced and capable management personnel.
3. Establishment of uniform grade standards for apples that will gain a recognition for high and consistent quality.
4. Provision for product identity and promotion.
5. Study of apple market operations and gradual entry into the market structure.
6. Competent and honest accounting procedures serving all areas of activity.
7. Education and informational program for members and employees.

If the first years of operation of the Association are successful more growers will be attracted to membership. A gradual growth in fruit volume from select top quality growers will result in a number of advantages as follows:

1. Greater market impact and extension to more markets.
2. Greater efficiency of operation and a lower unit cost.
3. Increased operational revenue to underwrite debt service.

Increased volume of business, however, will eventually require a greater facility capacity. This may involve the construction of additional cold storage capacity and a mechanized fruit grading and packing operation.

REPORT EVALUATION

A. Cold Storage and Building Facilities

The plans and capacities of the proposed cold storage and packing building was carefully reviewed. Senor Carlos Rodriquez of INFRIGUA, Ltd. prepared a list of the refrigeration equipment and the general dimensions and capacities of the building. This information has been checked in detail with the engineers of the equipment manufacturers in the United States. Summaries of these investigations are included in Appendix I of this report.

In general the design capabilities of the equipment to be furnished in the bid submitted by INFRIGUA, Ltd., are adequate for the anticipated heat loads and the major components (compressors, condensers, evaporators) are in proper balance to assure an efficient operation. In fact, the compressors are designed to provide an additional capacity for a limited expansion program (5000 to 8000 bu.) in the future by increasing the R.P.M.

The prices for the refrigeration equipment quoted by INFRIGUA, Ltd. were checked against the manufacturer's wholesale price F.O.B. factory. The quoted price by INFRIGUA does not reflect more than an estimated 15-18% increase which is well within an acceptable range.

The design of the building which is a simple steel truss, steel clad building constructed on an insulated reinforced concrete floor is economical to erect and is durable and earthquake resistant. It will recuire very little maintenance and repair. Inside the steel building there will be assembled four insulated rooms that will stand

independent of the steel building. The walls and ceiling of these insulated storage compartments are prefabricated panels of four inches of styrofoam or an equivalent insulation material clad on both sides by an aluminum sheeting. These panels, if properly installed, will provide an adequate barrier to the transfer of both heat and moisture and should be durable over the full life span of the building. This method of both building and insulated storage compartments are in general use in the United States and have proven to be satisfactory.

The room arrangement (refer to Apendix I) is a logical arrangement to provide a good flexibility of operation. The precool or rapid cool room with a capacity of about 500 bu. of fruit is an excellent arrangement to withdraw the major heat load. It is logical that the temperature of the fruit can be reduced from 80°F to 45°F in six to eight hours. The fruit can then be transferred to the regular storage rooms for term storage. The rapid removal of field heat is a prime requirement in maintaining long storage life of the fruit.

In filling the larger, long term, storage rooms it would be advisable to fill all of them at the same time. As the fruit is removed from the precool room it can be placed in the long term storage rooms in such a way that all of the refrigeration equipment for all of the rooms is removing the final heat from the fruit (from 45°F to 30°F).

In unloading the rooms during the shipping and marketing program all of the fruit can be removed from each room, one at a time. In this way the equipment for each room can be shut off as the room is emptied. In fact, in the operation of the cold storage there are many practices

that can be employed that will reduce the introduction of warm air into the rooms and the use of unnecessary electrical energy.

It is important to recognize that a refrigeration system and the proper operation of a cold storage for fruit is an application of high technology. Of utmost importance is a competent, well trained operating engineer of the refrigeration equipment. This is essential. He must be available 24 hours per day and 7 days per week. An assistant operator can relieve this schedule. The first year of operation can provide an opportunity to train an operator living in the local community, but the operating engineer should be a qualified person under the supervision of the contractor, INFRIGUA, Ltd.

In reference to the proper operation of the cold storage system it is very important that the contractor has offered within his bid to provide service and supervision during the first year of operation. The proper operation of the electrical and mechanical systems are essential. Minor adjustments in the controls and automatic components will be necessary. All must function under variable heat loads and atmospheric conditions.

B. Fruit Grading and Packing Operations

In the building design proposed by INFRIGUA, Ltd., there is a side building parallel to the cold storage compartments. One end will be occupied by the precool refrigerated room (20' x 18'). The other end will be occupied by the office and lavatories (20' x 18'). The balance of the building space (18' x 110') will be used for fruit grading and

packing. Next to this room there should be a paved or surfaced space for receiving fruit from the orchard and for receiving packing supplies. This is going to be a very busy and congested area and may require some additional expansion in the future.

The shipment of fruit to market will be from an exit by the cold storage rooms (see Appendix I -- plot plan). In any operational plan the flow of fruit and supplies to each operation is a very important part of an efficient operation. A careful study and evaluation must be made to eliminate areas of congestion and expensive lost effort.

Referring to the grading and packing operation, it is not recommended that mechanical equipment be installed or employed the first year of operation. The construction of simple benches, tables or bins will probably be adequate. The fruit will be emptied from the field containers and separated into appropriate grades of quality. The fruit may be further separated into separate categories by size of fruit. The degree of separation by quality and size will depend upon the grade standards decided upon by the Association. This will be considered in a later section. In any case it is contemplated that the operation of grading and packing will be a manual operation. The efficiency of this operation will depend upon the specific instructions and training given the employees and the proper arrangement of the work area. It is also important to carefully plan the procedure of providing fruit and packing supplies to the area and the removal of the packed fruit to the storage.

During the investigation an estimate of 500 bushels or boxes of apples was indicated as a maximum daily delivery. It would be logical

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that the daily delivery of fruit from the orchard will vary greatly from day to day. Some flexibility must be provided in grading and packing operation to accommodate this variation, such as longer work days, temporary storage in one of the storage rooms, or a temporary shelter in the receiving area.

Of utmost importance is the supply of packing material and the shipping containers. Storage space for these materials is very limited and thus a dependable supply on short term notice is essential.

In future years when grades, size separations, packing materials and shipping containers are established the sophistication of the packing operation can be developed. Mechanical equipment can be installed that will automate many of the procedures. Capital investments in this equipment will be offset by reduced labor costs, more uniform grades and packing and greater output capacity.

C. Fruit Marketing

Many would agree that the marketing of an agricultural product is the most important operation. It has the greatest potential of being the most important factor of success or failure of any agricultural enterprise. The board of directors and management of the Association should consider this matter most seriously. At the present time there is an established practice or procedure of marketing. The cash buyer or trucker contacts the growers and arranges a sale. He presumably has a contact in the terminal market, (Guatamela City), who in turn buys the fruit and sells it to a multiple of outlets. The Association should recognize this established market procedure and realize that by

collectively grading and packing their fruit and offering it to the market in larger quantities it poses either a threat or an opportunity to the established market elements. It is suggested that the Association should not confront or antagonize the principles in the market if it can be avoided. It may be the best diplomacy to use the "trucker-buyer" and to cultivate his assistance by a uniform quality grade and package in volume quantities. It is also to his interest to have a one stop pick up in full truck-lot quantity.

It is important to note the most important element in any market program is a high quality product offered in a consistent supply to a market. The market should be interpreted as any and all of the elements in the chain of transactions that specifically buy the fruit. The most important of all these elements is the ultimate consumer who either recognizes his or her purchase as good or bad. It is essential that repeat purchases will express a preference for your product. This preference will be extended back through the market chain to the ultimate producer. This then establishes the importance of a consistent high quality product which will support consistent demand and a preferential price. One of the basic elements to coincide with product quality is product identity. This product identity should be extended to the ultimate consumer if possible. This can be accomplished by a distinctive grade, package, label or all three. In some cases a distinctive stamp has been placed on each piece of fruit.

Once product identity is established with a corresponding demand the Association can take steps to by-pass or eliminate the steps in the

market chain of transactions. The more direct the Association can be in its relation to the ultimate retailer the greater will be the Association's share of the retail price of its product. All of this will help to pay for the extra effort to offer and to promote a quality product. It is prudent to suggest this objective in marketing may be a long term objective and should be carefully and systematically accomplished.

D. Physical Operations

In the summary introduction it was noted that the Association will grade and pack the fruit of its members, it will provide production supplies, it will supervise harvest operations, it will transport fruit from the orchard to the packing - storage station, it will grade, pack and store the fruit and it will market the fruit and account to its members for the service charges and fruit proceeds. It is important to emphasize that the grower members, in reality, are the Association and they also will do certain things. They will cooperate with their directors, their manager and their Association to accomplish their collective goal. The grower members will make use of good cultural practices in cooperation with the horticulturists; they will cooperate in proper harvesting procedures; they will support the Association with all of their fruit and they will assist the Association in the delivery of their fruit to the Association. The delivery of a high quality product to the Association is the most important step in delivering a high quality product to the consumer. Once the fruit reaches the Association it can only separate qualities and prolong the quality life of the apple through storage.

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One of the first considerations of the Association will be the standards of grade that will be applied uniformly to all crops delivered. What will be the requirements for No. 1 or first grade? What will be the requirement for No. 2 or second grade? What will be culled or discarded? In the absence of Federal or State grades these decisions must be made by the grower members and the board of directors.

It is suggested that in order to increase the capacity of the volume of fruit the Association can accommodate that only No. 1 grade fruit be held in storage for the late market. The No. 2 grade and lower grades can be sold at harvest time. This fruit will not carry the top quality label or identification of the Association and it will only sell for the harvest period price. By this practice a supply of fruit will be sold and shipped by the Association for a much longer period and the expense of cold storage will be invested in only the high quality or No. 1 grade fruit. An additional benefit will result by spreading the fixed or overhead costs of the Association over a larger volume of fruit. It is not unreasonable to project that the total volume of fruit received by the Association could be two times the rated capacity of the cold storage rooms.

In the harvesting and handling of the fruit it will eventually be necessary to consider the containers for both harvest and marketing. In most commercial apple producing areas the shipping or market container is totally separate from the harvest container. This is a problem that must be solved by the Association. When the Association considers this problem two factors should be noted. First the shipping container should stack in cold storage to at least ten high with good

stability and it should deliver fruit to the market with maximum protection to the fruit. Second the picking container should be durable and capable of being used over a period of eight to ten years. In most commercial apple producing areas of the world a molded plastic container holding about 45 pounds of fruit is used as a harvest or picking box. A corrugated fibre telescope carton is used as the shipping container. A "wet strength" material is used by the carton manufacturers in order to prevent moisture absorption in storage. Molded cup type trays are used for each layer of fruit in the carton.

E. Corporate Organization and Management

A chartered corporate association is a business organization. It must keep proper records and report all of its financial and corporate activities to its members at least once each year. These records and reports are developed by a board of directors elected by the members and a corporate manager employed by the board of directors. It is important that the powers, duties and responsibilities of the board and the manager are carefully and specifically determined. As an aid to assure a proper function of the Association an organizational chart should be prepared which should diagram the relationships of all parties in the Association. It should include members, board of directors, manager, supervisors and such other employees who perform important functions. For each there should be listed the following: qualifications, duties, authority, responsibilities and lines of communication.

For all employees there should be developed a program of training and education and some system of recognition and reward for superior

performance. This can be arranged for employees at all levels; sorters packers, supervisors, storage operators, clerks and the manager.

As a general rule the board of directors are responsible for the operating policies of the Association and the manager is responsible for the implimentation of these policies. The manager is responsible for the day to day operation of the Association and the employment and supervision of all employees. He further reports to the board of directors all activities of the Association at regular meetings. The reports are in the form of financial statements, operating statements, budgets, narrative reports, financial projections, audits, market reports, etc. The board of directors will evaluate management performance on the basis of these reports.

ACKNOWLEDGMENTS

The preparation of this report was possible only with the full cooperation of all persons involved in the visitations. Special recognition should be given to growers and directors of the Cooperative Association of Chichicastenango; to Lic. Edgar Barrios, Director Executive of the Institute of Cooperatives, to Francisco Rios, Assessor, Institute of Cooperatives and to Sr. Carlos Rodriguez, Engineer, INFRIGUA, Co. Ltd.

A special commendation must be given to David Fiedderjohn Regional Representative of A.C.D.I. Serving as interpreter and advisor he performed a most valuable service in the preparation of this report.

To all these people I express my sincere appreciation for their advice and counsel and their many courtesies and friendly welcome.

APPENDIX # 1

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EQUIPMENT PERFORMANCE EVALUATION

UNIT COOLER - FL740 (BOHN) (3) 3/4 HP MOTORS

Unit will remove 85,000 BTU/HR (7.08 tons) @ 10 DEG. TD and +20 DEG. suction

Comment: This would be adequate for Room A calculated load of 6.32 tons.

UNIT COOLER - FL400 (BOHN) (3) 1/2 HP MOTORS

Each unit will remove 45,000 BTU/HR X 2 units per room = 90,000 BTU total evap. capacity (7.5 tons) for each Room, B, C, or D.

Comment: This would be adequate for Room B,C, or D, calculated room loads of 7.64, 7.48, and 7.64, respectively, considering the calculated load safety factor.

COMPRESSOR - TECUMSEH CM WITH 15 HP MOTOR

Compressor will have adequate capacity with a 15 HP drive with proper pulley selection. A 15 HP motor is more that adequate for the job.

CONDENSOR - BOHN MODEL (PROBABLY RDD 13) @30 DEG. TD = 180,000 BTU/HR

Note: Catalog shows 180,000 THR, however, I would figure actual condensing capacity at 153,720 THR at 9,000 FT altitude.

If compressor pulley selections provide for compressor capacity matching that of the calculated loads, the following results could be expected of the condensing unit:

ROOM A SYSTEM

75,796 X 1.24 = 93,987
115 DEG cond. - 85 = 30 DEG design TD
RDD 13 capacity = 153,720

actual TD = (30 X 93,987) / 153,720

actual TD = 18 DEG. TD

approximate operating head pressure = 126 PSIG

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ROOMS B, C, OR D

91,646 X 1.24 = 113,641
design TD = 30 DEG.
RDD 13 capacity = 153,720

actual TD = (30 X 113,641) / 153,720

actual TD = 22 DEG

approximate operating head pressure = 133 PSIG

REFRIGERATION MATERIALS COST EST.

FL400	each	=	$ 2,000
	2,000X6	=	12,000
FL740	each	=	3,300
RDD 13	each	=	2,200
	2,200X4	=	8,800
Compressors CM	each	=	2,000
	2,000X4	=	8,000
15 HP Motors	each	=	600
	600X4	=	2,400
Heat Exchg.	each	=	250
	250X4	=	1,000
Sight Glass	each	=	10
	10X7	=	70
Replacable Core Driers	each	=	70
	70X4	=	280
Expansion Valve	each	=	30
	30X7	=	210

(suggest use of Sporlan Model 0 Valve or Bohn Bohrmiser Valve)

Copper Pipe Fittings Est.	2,500
Misc. Parts	2,000

TOTAL WHOLESALE 40,560 vs 47,600 @ 18% mark/up max.

COMMENTS

1. System capacity is figured on the basis of a 16 hr. operation time for the equipment to allow for defrost and cycle time.

2. If warm fruit is to be loaded directly into Room B, C, or D from the packing line, it is suggested that a loading rate of 436 bushels per day per room not be exceeded.

3. It is important to provide for good air movement in all parts of the room. This can be accomplished by stacking the fruit so that the rows are parallel to the air flow of the cooling units and that space is left between the walls and fruit stacks. Fruit should not be stacked to a height that will block unit air flow.

4. If possible, the condensors should be located close to the compressors they serve.

5. A pump down system and crankcase heater is recommended to protect against off cycle refrigerant migration.

6. The condenser should be provided with head pressure controls for cold ambient operation.

AIR CHANGE LOADS

ROOM	A/C 24HRS	BTU/CUFT	TOTAL BTU/24HRS
A	6.3	2	54432
B	2.3	2	110400
C	2.3	2	110400
D	2.3	2	110400

PRODUCT LOADS

ROOM	SP.HEAT	LOAD,LBS.	TEMP IN	COOLED TO	RESP/RT	RESP.LB	FIELD HEAT/24HRS.	RESP.HEAT/24HRS.	TOTAL
A	.86	24000	75	40	.72	24000	722400	17280	739680
B	.86	24000	45	30	.72	400000	309600	288000	597600
C	.86	24000	45	30	.72	400000	309600	288000	597600
D	.86	24000	45	30	.72	400000	309600	288000	597600

MISC. LOADS

ROOM	PEOPLE	MOTORS	LIGHTS	OTHER	TOTAL
A	45600	162000	0	0	207600
B	45600	216000	0	0	261600
C	45600	216000	0	0	261600
D	45600	216000	0	0	261600

ROOM LOAD SUMMARY

ROOM	TOTAL BTU/24HRS	BTU/16HRS	SAFETY FACTOR	GR.TOTAL	TONS
A	1102488	68905.5	6890.55	75796.05	6.32
B	1333040	83315	8331.5	91646.5	7.64
C	1305200	81575	8157.5	89732.5	7.48
D	1333040	83315	8331.5	91646.5	7.64

INDUSTRIOS, FRIGORIFI
CAS DE GUATEMALA
MR. CARLOS RODRIGUES

OUTDOOR DESIGN	DRY BULB	87
	WET BULB	73
	R/H	.5
	GR. TEMP	60
INDOOR DESIGN	TEMP.	30

	TEMP.DIFF	T/F(BTU/24HR/SQFT)
WALLS	57	58
CEILINGS	57	58
FLOORS	30	75

DEMENSIONAL DATA

ROOM	HEIGHT	WIDTH	LENGTH	EXP.WALLS	FLOORS	VOLUME
A	12	18	20	912	360	4320
B	12	40	50	1680	2000	24000
C	12	40	50	1200	2000	24000
D	12	40	50	880	2000	24000

TRANSMISSION LOADS

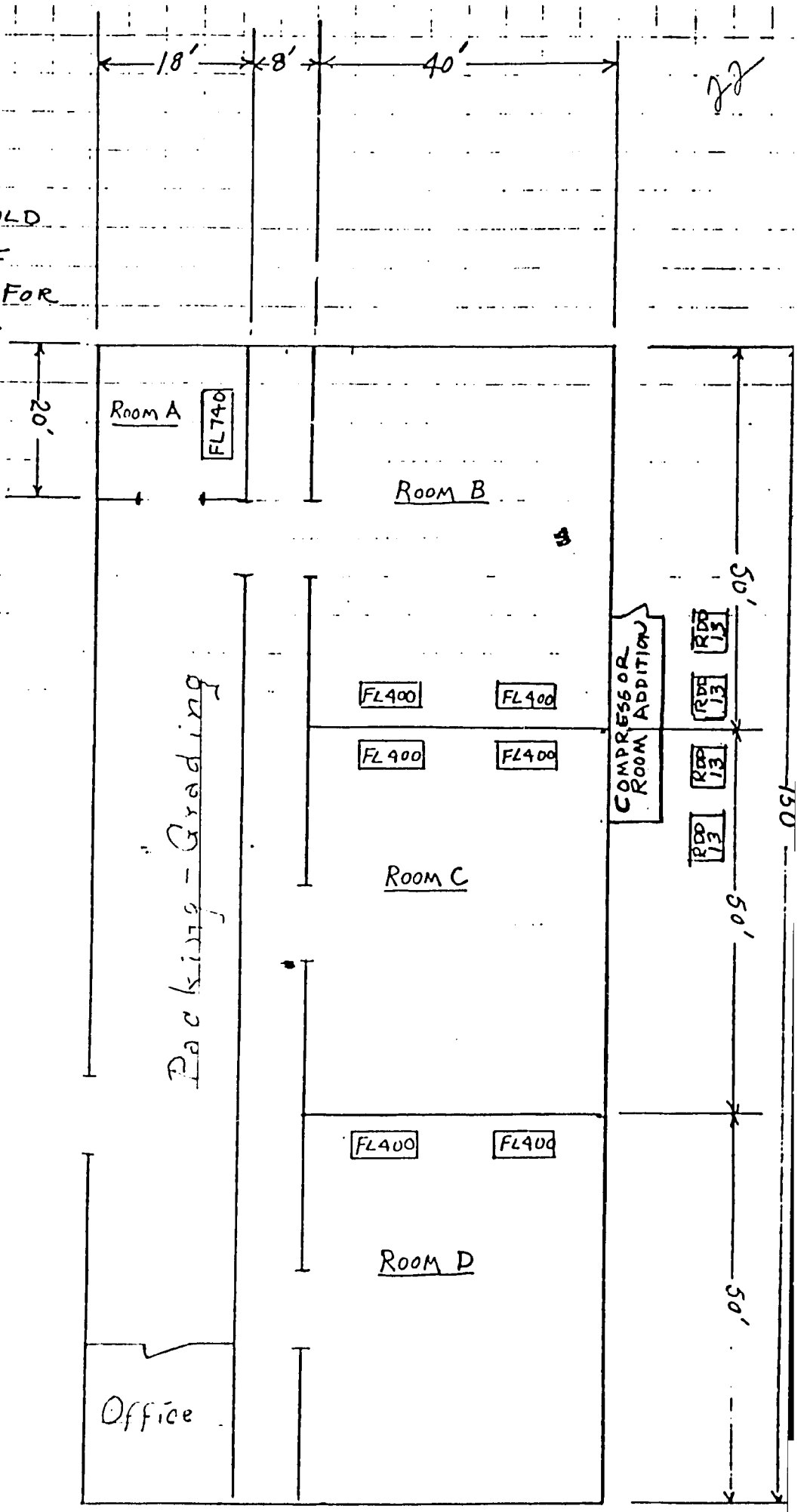
ROOM	WALL LOAD	CEILING	FLOOR	TOTAL BTU/24-RS
A	52896	20880	27000	100776
B	97440	116000	150000	363440
C	69600	116000	150000	335600
D	97440	116000	150000	363440

NDUSTRIOS, FRIGORIFI
AS de GUATEMALA
MR. CARLOS RODRIGUES

OTE: COMPRESSOR ROOM COULD BE ADDED TO BACK OF BUILDING TO PROVIDE FOR EFFECTIVE GROUPING OF COMPONETS.

OPTION # 1 - Arrangement

Refrigeration equipment



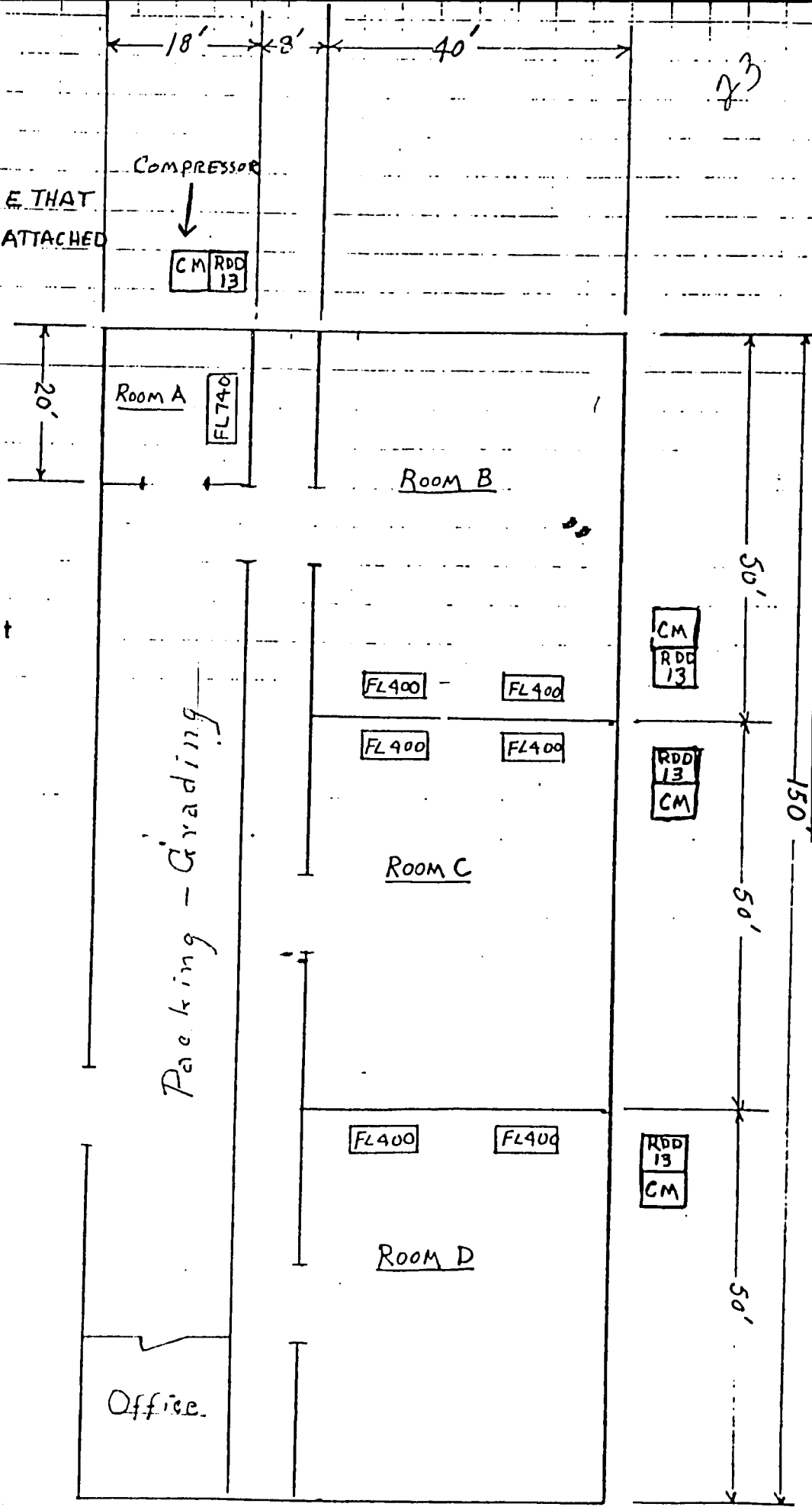
AS de GUATEMALA

MR. CARLOS RODRIGUES

TE: THIS PLAN WOULD REQUIRE THAT A COMPRESSOR SHELTER BE ATTACHED TO EACH CONDENSER.

OPTION #2 - Arrangement

Refrigeration equipment



AS de GUATEMALA

MR. CARLOS RODRIGUES

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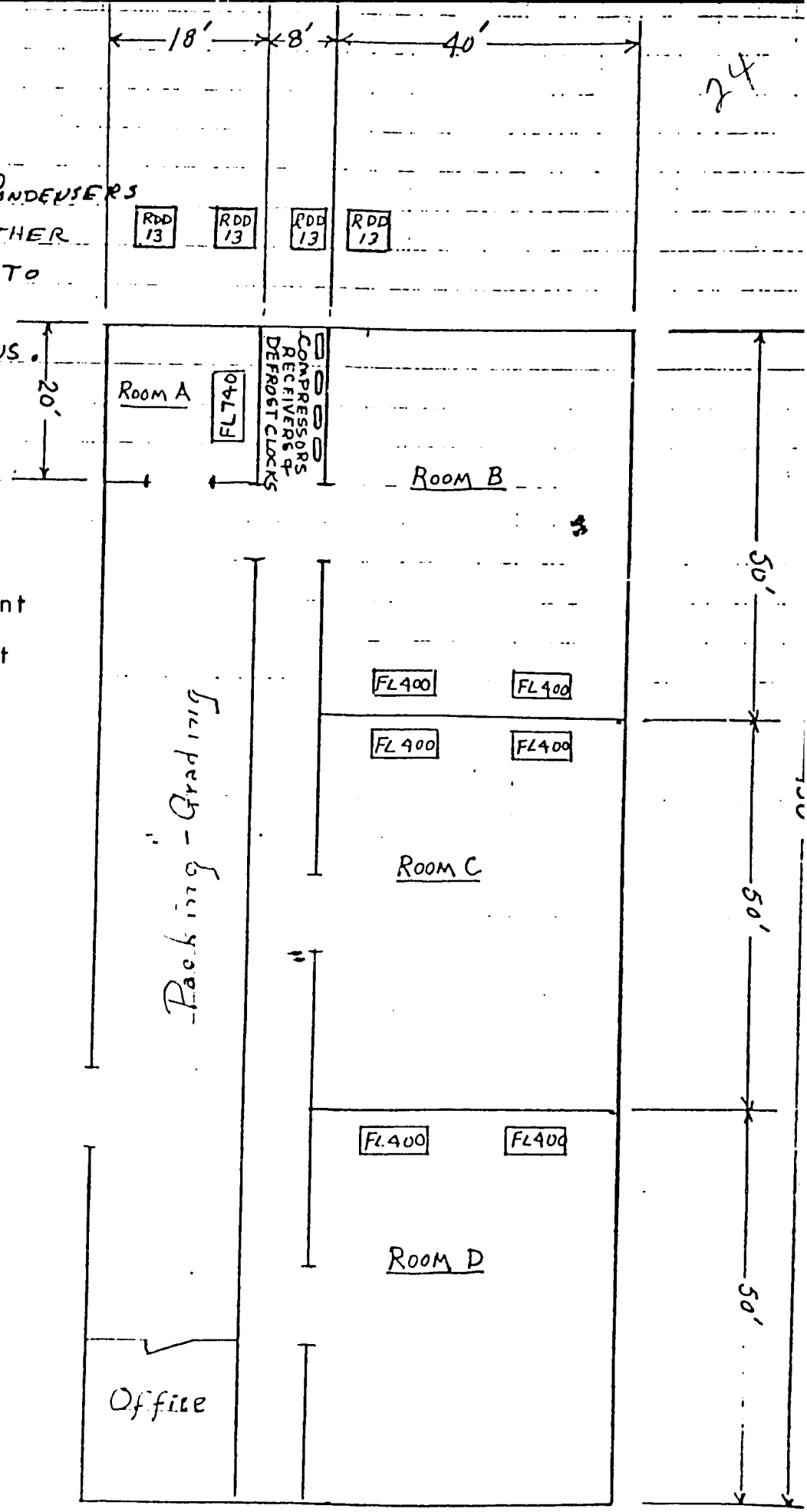
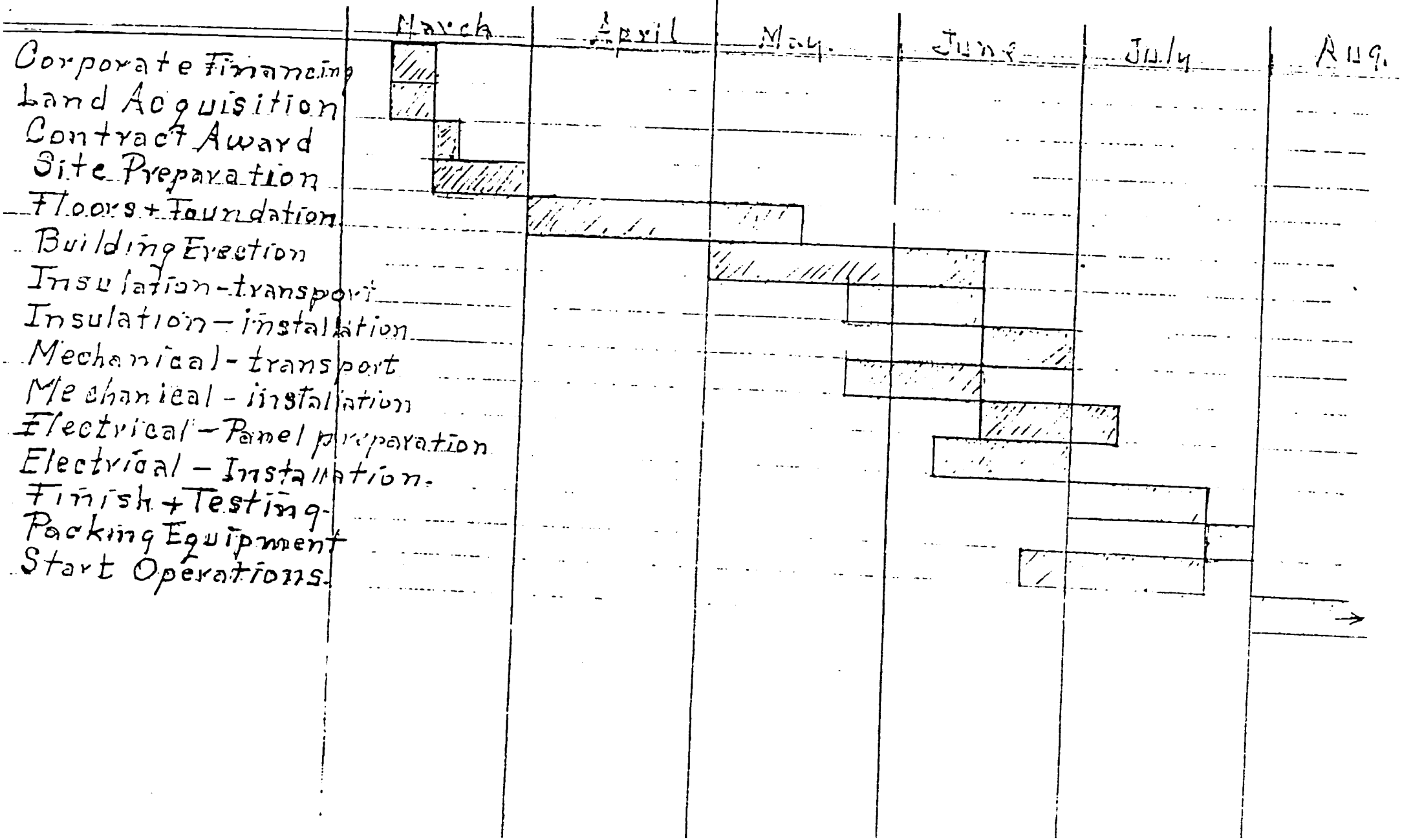
OTE: COMPRESSOR ROOM & CONDENSERS COULD BE LOCATED AT OTHER END OF BUILDING NEXT TO ROOM D, DEPENDING ON FUTURE EXPANSION PLANS.

OPTION # 3 - Arrangement

Refrigeration equipment



Appendix II
Time Schedule.